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Insurance and Portfolio Decisions: Two Sides of the Same Coin?

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Abstract

We study insurance and portfolio decisions, two opposite risk retention tradeoffs. Using household level data, we identify the first joint determinants (e.g. subjective expectations, risk attitude) and frictions (e.g. liquidity constraints, financial literacy) in the literature. We also find key differences between the two decisions. Notably, contrary to economic intuition, risky asset holding and insurance coverage both increase with wealth. We show that this apparent puzzle is driven in part by a specific behavioral pattern (the poor invest too conservatively, while the rich over-insure), and can be explained by two factors: regret avoidance and nonperformance risk.

Keywords: Portfolio decisions, insurance, wealth.
JEL classification numbers: D14, D81, C3.

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1 Introduction

The decision to insure against the risk of monetary loss and the decision to invest in risky assets reflect the same, albeit opposite, risk retention tradeoff. Namely, an agent reduces her exposure to risk by purchasing insurance, while she increases her risk exposure by investing. Factors that promote the demand for risky assets by shifting risk attitude should therefore lower the demand for insurance. For instance, because the wealth elasticity of demand for risky assets has been shown to be positive,[1] insurance coverage should decrease with wealth. The objective of this paper is to understand better how households manage their financial risks by exploring the extent to which portfolio and insurance decisions share the same determinants and frictions.

To do so, we rely primarily on survey data for a representative sample of U.S. households heads which include detailed micro-level information on wealth composition, portfolio distribution, property insurance, as well as demographic and behavioral characteristics. The analysis produces four novel results. First, we identify the first joint determinants of portfolio and insurance behavior in the literature. In particular, the two decisions respond to subjective expectations and risk attitude as predicted by theory. We also find several frictions, including liquidity constraints, impatience, financial literacy and information, that impede both the demand for risky assets and the demand for insurance. Second, we find that insurance is a normal good. That is, all else equal, and in particular after controlling for the value of the good insured as well as objective and subjective risks, wealthier respondents purchase more insurance coverage. This is an important result that contrasts with most of the insurance literature. Third, we identify an apparent puzzle, the "insurance-portfolio puzzle," in the sense that, contrary to the prediction of canonical models, an individual's risky asset holding and insurance coverage both increase with wealth. This puzzle is robust as it holds also within-person, across insurance contracts (auto, homeowner), across data sources (survey, administrative, experimental) and in different countries. Fourth, we show

[1] See e.g. Campbell (2006), Wachter and Yogo (2010), or Calvet and Sodini (2014).

that the insurance-portfolio puzzle can be explained (both empirically and theoretically) by the combination of two factors: regret avoidance and nonperformance risk (the risk that a financial contract fails to perform as expected). To the best of our knowledge, this is the first paper that shows why the demand for insurance is positively correlated with wealth.

In their recent review of the literature, Gomes, Haliassos and Ramadorai (2021) argue that two areas of household finance are still understudied: households attitude toward insurance and the interdependence between different financial decisions. This paper attempts to fill these gaps. To do so, we link two strands of the literature. The first relates to the extensive empirical literature on portfolio choices and their determinants.[2] The second relates to the recent literature that uses micro-level data to explore insurance choices. This literature initially focused on testing for asymmetric information in insurance markets,[3] and whether risk preferences are stable across contexts.[4] More recently, several contributions have helped expand our understanding of insurance markets (e.g. Gennaioli et al. 2022, Egan, Ge and Tang 2022). Nevertheless, as noted by Gomes et al. (2021) and Koijen and Yogo (2022), the drivers of households' insurance decisions are still largely unknown. More generally, little is known about the way households combine portfolio and insurance decisions to manage their risk exposure. To the best of our knowledge, this is the first study that identifies jointly determinants and frictions that are common to both decisions.

This paper also contributes to the growing empirical literature that tries to clarify the relationship between wealth and the demand for insurance. A number of studies have provided suggestive evidence that insurance may be a normal good (see e.g. Guiso and Japelli 1998, or Millo 2016 for a review). These studies, however, suffer from limitations because they rely on aggregate data or they do not control for key micro-determinants which are likely to be correlated with wealth (e.g. the value of the good insured or the risks faced by the insured).[5] Concurrently with our paper, Gropper and Kuhnen (2022) also document

[2] For recent reviews, see Guiso and Sodini (2013), Beshears et al. (2018), or Gomes et al. (2021).
[3] See Cohen and Siegelman (2010), Einav, Finkelstein and Levin (2010), or Chiappori and Salanié (2015).
[4] For a recent review, see Barseghyan et al. (2018).
[5] For instance, Cohen and Einav (2007) report evidence "*suggestive of a nonnegative, and perhaps positive,*

a positive correlation between wealth and insurance coverage using micro-data. Our paper complements Gropper and Kuhnnen (2022) in at least two ways. First, we show that the positive correlation holds after controlling for additional important confounds (notably, risk and time preferences, objective and subjective risks, financial literacy). Second, we provide a solution to the puzzle: the relationship between wealth and insurance become negative, as predicted by theory, when we account for regret avoidance and nonperformance risk.

The paper is structured as follows. Section 2 provides a short theory background. The econometric approach and the data are presented in Section 3. Descriptive statistics and prima-facie evidence for the insurance-portfolio puzzle are provided in Section 4. Estimation results are discussed in Section 5. Robustness checks are conducted in Section 6. We show in Section 7 that the insurance-portfolio puzzle reflects deliberate decisions resulting from regret avoidance and nonperformance risk. Finally, Section 8 concludes.

2 Theory Background

To motivate our empirical analysis, we start by illustrating how the two canonical models of portfolio (Pratt 1964) and insurance (Mossin 1968) decisions are in fact equivalent. Consider an agent with wealth w who faces a random financial loss $\tilde{L}$. The loss is insurable. The insurance contract is such that the agent receives an indemnity αL in case of loss L. The insurance premium is equal to $\alpha\pi$ where π is the full insurance premium. The agent decides the level of insurance coverage α that maximizes expected utility given a strictly increasing, concave and twice differentiable utility function u. Formally,

$$max_{\alpha} Eu[w - \alpha\pi - (1-\alpha)\tilde{L}] \,. \tag{1}$$

The model above can be rewritten

$$max_{a} Eu[w_0 + a\tilde{X}] \,, \tag{2}$$

association between income/wealth and absolute risk aversion" (page 762), but they do not have individual data on income or wealth, and they do not control for possible confounding factors (e.g. subjective risks).

where $w_0 = w - \pi$, $a = 1 - \alpha$ and $\tilde{X} = (\pi - \tilde{L})$. The purpose of this change in notations is to show that the coinsurance demand model à la Mossin (1968) is equivalent to Pratt (1964)'s portfolio decision model, as is well known (Gollier 2001). In the portfolio model, a is the amount invested in the (net) risky asset, and the optimal solution is characterized by

$$E\tilde{X}u'[w_0 + a\tilde{X}] = 0\,. \tag{3}$$

Note that the left hand side is positive when $a = 0$ iff $E\tilde{X} > 0$. Therefore, we have $a > 0$ iff the expected value of the risky asset is positive, i.e. $E\tilde{X} > 0$. Equivalently, in the insurance demand model, we have less than full insurance, $\alpha < 1$, when insurance is not actuarially fair, i.e. $\pi > E\tilde{L}$.[6]

This isomorphism between portfolio and insurance decisions implies that factors that shift insurance coverage in one direction, shift risky investments in the opposite direction. Consider for instance the effect of wealth. Since Pratt (1964), it is well known that a increases in wealth w_0 iff u exhibits decreasing absolute risk aversion (DARA). Using standard comparative statics techniques, we can see that a increases in w_0 iff $E\tilde{X}u'[w_0 + a\tilde{X}]$ increases in w_0 at the optimal solution, namely iff $E\tilde{X}u'[w_0 + a\tilde{X}] = 0$ implies $-E\tilde{X}u''[w_0 + a\tilde{X}] \leq 0$. This implication means that an agent with utility $-u'$ is willing to invest less in the risky asset than an agent with utility u, or equivalently that $-u'$ is more risk averse than u. This is equivalent to DARA, namely to $\frac{-u''(w)}{u'(w)}$ decreasing in w. Using the isomorphism between portfolio and insurance decisions, this result then implies that the optimal insurance coverage α decreases in wealth iff u is DARA (Mossin 1968). Note that this result is robust to relaxing some of the model's assumptions. In particular, the opposite effects of wealth on insurance and portfolio choices holds with deductible contracts (Schlesinger 2013), when insurance and investments are made jointly (see appendix B.1), and in a two-period model in which savings and insurance decisions are made simultaneously (see appendix B.2).

[6] Gollier (2003) reports insurance loading factors of 30% which implies that premia are actuarially unfair.

3 Model Specification and Data

3.1 The Baseline Model Specification

To identify common determinants and frictions, and to account for the possible interdependence between choices, we estimate a joint econometric model for portfolio and insurance decisions at the individual level. Following Einav et al. (2012), we specify a seemingly unrelated regression model with limited dependent variables:

$$\begin{cases} I_i = \alpha_0 W_i + \alpha_1 X_i + \alpha_2 Y_i + \varepsilon_i^I \\ R_i = \beta_0 W_i + \beta_1 X_i + \beta_2 Z_i + \varepsilon_i^R \end{cases} \tag{4}$$

where the endogenous variables I_i and R_i, the measures of agent i's insurance coverage and risky asset holding, are both left censored (at zero) and right censored (depending on the definition of I_i and R_i in Section 3.2); W_i is the inverse hyperbolic sine of agent i's wealth;[7] X_i is a vector of individual characteristics; Y_i and Z_i are variables pertaining to the agent's insurance and investment decisions, respectively; and $\left(\varepsilon_i^I, \varepsilon_i^R\right)$ are errors terms that follow a bivariate normal distribution with correlation ρ_{IR}. The model is estimated by full information maximum likelihood.

The main exercise of the paper is to compare pairs of parameters (α_k, β_k) to test whether the two decisions have the same determinants and frictions. In particular, holding other individual characteristics constant, we test the hypothesis that wealth has an opposite effect on an agent's portfolio and insurance decisions: $H_0 = \{\alpha_0 < 0, \beta_0 > 0\}$.

3.2 The Data

The Survey of Consumer Expectations (SCE). The SCE is a financially incentivized, monthly, internet survey produced by the Federal Reserve Bank of New York since June

[7] As discussed in Section 4, 12% of households in our sample have negative wealth. Hence, using the log of wealth is not possible for everyone. Instead, we use the inverse hyperbolic sine, defined as $Sin^{-1}(x) = ln\left(x + \sqrt{1+x^2}\right)$, which mimics the shape of the log function on the real line.

2013.[8] While we use other waves of the survey, our main data set comes from three special surveys conducted in 2015, 2016 and 2021 focusing on household finance and property insurance (auto and homeowner/renter insurance).[9] To answer our questions as precisely as possible, respondents were encouraged to consult any relevant documentation such as tax returns, bank and investment statements, and insurance contracts. The main data set consists of a cross-section of 3,194 respondents (898 in 2015, 913 in 2016 and 1,383 in 2021).[10]

Measures of auto insurance coverage (I_i). To measure insurance coverage, vehicle owners in the SCE are asked about seven different components of coverage for their main vehicle (defined as the one with the highest current value): 1) Liability coverage (to cover the damage caused by the insured to others), 2) personal injury or medical protection (to pay for the insured's and the insured passengers' medical bills resulting from an accident regardless of who is at fault), 3) uninsured and underinsured coverage (to cover the insured's expenses when the other party is at fault and does not have any or enough insurance), 4) collision coverage (to repair or replace the insured's vehicle after an accident, regardless of who is at fault), 5) comprehensive coverage (to repair or replace the insured's vehicle after any damage not due to a collision such as theft, hail, fire, vandalism), 6) rental coverage (to pay for a rental car while the insured's vehicle is being repaired), and 7) towing/road side assistance. Based on the responses to these questions we can characterize a respondent's vehicle insurance coverage by a seven-dimensional vector.

The liability and injury components can take three values (ranging from 0 to 2): i) no coverage, ii) the coverage equals the minimum required by law, iii) the coverage exceeds the minimum required by law.[11] The collision and comprehensive components can take five values (from 0 to 4): i) no coverage, ii) coverage with a deductible greater than $1,000, iii)

[8] Data from the SCE have been used to address both policy and research questions. See e.g. Brown et al. (2016), Armona, Fuster and Zafar (2019), or Faberman et al. (2022).

[9] We focus on property insurance because, as argued by Barseghyan et al. (2018), they entail mostly financial losses and are thus more directly comparable to investments than (e.g.) life or health insurance.

[10] The questions asked in the household finance and insurance surveys are available on the SCE website.

[11] The coverage required by law varies across states. Thus, comparing the liability and injury component of respondents in two different states is not perfectly adequate. To address this issue, we will conduct robustness checks in Section 6 in which we restrict the sample to states with similar legal minima.

coverage with a deductible between \$501 and \$1,000, iv) coverage with a deductible between \$251 and \$500, v) coverage with a deductible lower than \$250. The uninsured component can take five values (from 0 to 4): i) no coverage ii) coverage up to \$10k, iii) coverage between \$10k and \$50k, iv) coverage between \$50k and \$100k, v) coverage in excess of \$100k. The rental and towing components can take two values each (0 or 1): i) no coverage, ii) coverage. Note that each component of respondent i's insurance coverage vector $C_i = (c_{i,1}, \ldots, c_{i,7})$ is ordered from less to more insurance. In particular, $C_i = 0$ implies that the respondent owns a vehicle but does not have insurance.

Previous analyses of the U.S. auto insurance market have focused on a small subset of the coverage vector. For instance, the classic paper of Puelz and Snow (1994) focuses on collision coverage only, while Barseghyan et al. (2013) restrict the analysis to the choice of deductibles for collision and comprehensive coverage.[12] Instead, this paper is the first to take a comprehensive perspective by summarizing the multi-dimensional insurance coverage vector into a single index. Because there is no objective way of doing so, we consider four different indexes. The first index is simply the normalized sum of each component: $I_{i,1} = \sum_{j=1,..,7} c_{i,j}/k_j$, where k_j is the number of possible values the insurance component j can take minus one. For instance, consider a respondent whose insurance contract consists only of the legally required liability coverage. In that case, $c_{i,1} = 1$, $k_1 = 2$ (because the liability coverage component can take three values), $(c_{i,2}, \ldots, c_{i,7}) = 0$, and $I_{i,1} = 0.5$. The index $I_{i,1}$ thus varies from 0 (no coverage) to 7 (full coverage).

The second index is equal to the (empirical) cumulative distribution of the insurance coverage vector: $I_{i,2} = F(C_i)$. Thus, $I_{i,2}$ is a relative index of coverage because it measures how well a respondent is insured compared to the vehicle owner population in the SCE. In particular, $I_{i,2} = 0$ (respectively $I_{i,2} = 1$) means that no other respondent has less (respectively more) car insurance coverage. The third index, $I_{i,3}$, is equal to the first component (i.e. the component that captures most of the variance) in a principal component analysis

[12] Similarly, Chiappori and Salanié (2000) summarize car insurance in France into a binary choice (minimal vs. full coverage), while Cohen and Einav (2007) focus on two deductible levels for the Israeli market.

of the insurance coverage vector. The fourth index, $I_{i,4}$, is a subjective measure. Namely, respondents in the 2016 and 2021 surveys were asked to rate their overall level of car insurance coverage on a 7-points Likert scale (from "no coverage at all" to "best coverage possible").

Each of these indexes has strengths and weaknesses. In particular, $I_{i,1}$ is simple to interpret but it gives an equal weight to each insurance component. In contrast, $I_{i,3}$ is less ad hoc but its interpretation is less clear. As shown in Section 4, there is a strong correlation between the four indexes. Further, unlike any single component of the vector of insurance coverage C_i, each index is highly correlated with the annual car insurance premium paid by the respondent. Thus, the four indexes capture relevant and related information about the respondent's car insurance coverage. The simple index, $I_{i,1}$, is used to estimate the baseline model. The other three indexes are used to conduct robustness tests.

Measures of wealth and investments in risky assets (W_i and R_i). We calculate a household's wealth as the sum of the current market value of assets owned by the household minus all liabilities owed. Following Brunnermeier and Nagel (2008), we consider two measures of wealth: financial wealth and net wealth. The assets considered to calculate a respondent's financial wealth consist of savings and investments (money on checking and savings accounts, CDs, stocks, bonds, mutual funds, Treasury bonds), retirement savings (in IRA, 401K, 403(b), 457, thrift savings plan), and other miscellaneous (non-housing) savings and assets (jewelry, valuable collections, vehicles, cash value in a life insurance policy, rights in a trust or estate). The liabilities considered to calculate financial wealth consist of any outstanding (non-housing) debt (credit cards balances, car, student or personal loans, medical or legal bills). To calculate net wealth, we add to the household's financial wealth the current value of any home(s) and business shares owned, and subtract any outstanding loans against the household's home(s), including all mortgages and home equity loans.

We consider two measures of risky assets. The risky financial assets consist of the stocks and mutual funds owned by the respondent, while the total risky assets also include housing and business assets. These measures are considered both in absolute terms (dollar amount) and in relative terms. The baseline model is estimated in Section 5 with financial wealth and the share of risky financial assets. Robustness tests are conducted using the other measures of wealth and risky assets.

Insurance and investments specific covariates (Y_i and Z_i). The insurance variables consist of the current value of the respondent's main vehicle, the annual premium paid to insure this vehicle,[13] the population density in the respondent's zip code (a variable typically used by insurance companies to measure risk exposure), a qualitative measure of the respondent's knowledge of his car insurance policy, a measure of the respondent's objective risks (based on the sum of all monetary damages incurred by the respondent over the past two years, including damages for which no claim was submitted),[14] and a measure of the respondent's subjective risks (based on the sum of all monetary damages the respondent expects to incur over the next two years).[15] Note that Barseghyan et al. (2018) advocate for the use of subjective beliefs, a variable ignored so far in the insurance literature, to help improve our understanding of financial decisions.

The portfolio variables include a measure of subjective expected returns (the respondent expected change in the U.S. stock market over the next 12 months),[16] and a qualitative measure of the respondent's knowledge about his debts and savings.

Individual characteristics (X_i). We control for standard demographic variables such as the respondent's age, gender, race, education, marital and employment status, and family

[13] We only observe the total premium paid, not the premium paid for each component or each unit of coverage.

[14] As discussed by e.g. Chiappori and Salanié (2000) or Cohen and Siegelman (2010), a common issue with previous studies of insurance is that damages are only observed if they lead to a claim. This is potentially a serious problem since the probability to submit a claim likely depends on coverage (e.g. drivers with high deductibles should submit fewer claims). We do not face this problem here since our measures of risks capture all damages including those for which the respondent does not submit a claim.

[15] Before answering each question, the respondent is asked to "*consider all the damages you may incur on that vehicle which you (or your insurance) would be financially responsible for (that is, bodily and property damages to you and to others due to collision(s) you caused, theft(s), hail, vandalism, and such)*." The variable "Objective Risk Auto" takes the value 0, 1 and 2 when the response is \$0, between \$0 and \$1,500, and above \$1,500, respectively. To make the two measures comparable, the variable "Subjective Risk Auto" is set to 0, 1 or 2 when the response is less than \$250, between \$250 and \$1500, and above \$1,500, respectively.

[16] As an alternative measure of subjective investment risks we also used the response to the question *"Imagine you were given \$1,000 to invest anyway you want. One year from now, how much do you think that investment would be worth?"*. Using this measure does not change the nature of the results presented below.

composition (i.e. whether or not the household includes children). In addition, we control for individual behavioral characteristics such as financial literacy (adapted from Lusardi and Mitchell 2007),[17] liquidity constraints (the reported probability to come up with $2,000 if the need arose), credit worthiness (the respondent's credit score), risk tolerance (based on Dohmen et al. 2011), and time preference (based on Falk et al. 2022).[18] To the best of our knowledge, this is the first time such variables are used to study insurance decisions.

4 Descriptive Statistics and Prima-Facie Evidence

Descriptive statistics are reported in Tables 1 to 6 and Figures 1 to 4. As we shall see, the data on wealth composition, portfolio allocation and insurance coverage all appear sensible.

Table 1 shows that slightly less than half of the respondents (the household head or co-head) is a female. Two out of three respondents are married or living with a partner and 38% of households include children. The median respondent is 49 and has a Bachelor degree. Table A1 indicates that the sample composition remained stable with respect to demographics between the 2015 and 2022 surveys.[19] Consistent with the analysis conducted by Armantier et al. (2017), respondents are essentially representative of the U.S. population of household heads with respect to gender, race, income, geography, and age, but they are slightly more educated than in the Census data.[20]

We report in Figure 1 the cumulative distributions of financial and net wealth, as well as the corresponding distributions of risky asset shares. Consistent with Saez and Zucman

[17] Here is an illustration of the type of questions we asked to elicit financial literacy: "*If you have $100 in a savings account, the interest rate is 10% per year and you never withdraw money or interest payments, how much will you have in the account after: one year? two years?*".

[18] To measure risk tolerance respondents are asked "*How would you rate your willingness to take risk regarding financial matters*" using a Likert scale ranging from 1 (not willing at all) to 7 (very willing). To measure patience respondents are asked "*In comparison to others, are you a person who is generally willing to give up something today in order to benefit in the future?*" using a Likert scale ranging from 1 (completely unwilling) to 10 (absolutely willing). Various studies have confirmed that these instruments produce meaningful measures of risk and time preferences and correlate with actual behavior (see e.g. Falk et al. 2022). To be clear, however, these measures are intended to reflect a respondent's attitudes toward risk and time. They are not estimates of the respondent's underlying preference parameters.

[19] Tables and Figures with numbers preceded by "A" can be found in appendix A.

[20] We refer the reader to Armantier et al. (2017) for a discussion of the SCE technical features, such as sample frame, implementation, response rate, and representativeness.

(2016), the distribution of wealth has a strong positive skew with a long right tail. Note also in Figure 1 that 12% of the respondents report having negative net wealth, meaning that their total debt exceeds the current market value of their assets.[21] The average financial wealth in Table 2 is $315k. A third of financial assets are concentrated in retirement savings, while a quarter consists of money in checking and saving accounts. Figure 1 also shows that 48% of respondents do not own any stock, either directly or indirectly in pooled investment funds. Conditional on owning stocks, the average share of risky financial assets is roughly one third (see Table 2).

Net wealth, with an average of $469k, is 50% larger than financial wealth (see Table 3). This is explained by the large share of assets concentrated in housing. Indeed, the homeownership rate is 68% in our sample, and the average home equity (conditional on owning a home) is $204k. The conditional share of risky financial assets is 62%, but 20% of respondents report owning no risky assets (see Figure 1 and Table 3). These statistics about wealth composition align well with similar data from the Census Bureau, the Survey of Consumer Finance, and previous literature.

Turning to Table 4, we can see that nearly every respondent (97%) owns a vehicle which they value at nearly $16k on average.[22] The proportion of respondents who have incurred damages over the past two years is 32%. The sum of all vehicle damages incurred over the past 2 years ($1.4k on average) and expected to incur over the next 2 years ($1.9k on average) are consistent (see Table 4). The correlation between the variables "objective auto risk" and "subjective auto risk," however, is only 0.2. This suggests that the two measures capture different information. The premia respondents report paying for car insurance are sensible. In particular, the average annual premium in the 2021 survey ($1,117) is in line with the figure from the National Association of Insurance Commissioners (NAIC) for the same year ($1,183).

[21] As discussed in Armantier et al. (2016), similar shares are found in the Survey of Consumer Finance, and they can be rationalized with a standard life cycle model in which households take on debt when young.
[22] These figures are in line with estimates from the *Transportation Research Institute,* as well as *Edmunds*.

We report in Figure 2 the distribution of coverage for each component of the auto insurance vector. Roughly two third of respondents have liability and personal injury coverage in excess of the legal requirement. The proportion of respondents with collision and comprehensive coverage is 83% and 80%, in line with the NAIC estimates of 79% and 76%. The most common range of deductibles for collision and comprehensive coverage is between \$251 and \$500, consistent with Barseghyan et al. (2013). While 80% of respondents have uninsured insurance, coverage is somewhat limited for most (two third have less than \$50k in coverage). Finally, more than half of the respondents have rental and towing coverage.[23]

Table 5 and Figure 3 show that the four indexes of insurance coverage are highly correlated and have relatively similar distributions. Further, we can see in Table 6 that the correlation between the index of coverage $I_{i,1}$ and the insurance premium of driver i is 0.23. Thus, $I_{i,1}$ is informative about insurance coverage. In contrast, the highest correlation between the premium and any of the seven components of car insurance is 0.12 in Table 6 (for rental coverage). Thus, $I_{i,1}$ seems to capture coverage better than any single component, such as the collision or comprehensive components used previously in the literature.[24]

We conclude this section by providing prima-facie evidence of the link between wealth, auto insurance coverage and risky investments. We plot in Figure 4 the average share of risky financial assets (X-axis) and the average index of insurance coverage I_1 (Y-axis) for each decile of financial wealth. The figure reveals a nearly perfectly monotonic relationship: as wealth increases insurance coverage and risky asset holding both increase. This provides prima-facie evidence against the hypothesis that the wealthy simultaneously invest more and insure less. In the next section, we test this hypothesis formally by estimating the baseline model in (4) while controlling for possible confounds.

[23] Tables A2 to A4 provide details on wealth composition and insurance coverage in each survey waves.

[24] Regressions accounting for relevant determinants such as objective and subjective risks, car value, or the driver's age also indicate that $I_{i,1}$ dominates any single component of coverage to explain the premium paid.

5 Estimation Results from the Baseline Model

We report in Table 7 the estimation results for the baseline model. Recall that the dependent variables are the index of auto coverage $I_{i,1}$ and the share of risky financial assets. We consider five different specifications.

Model 1: The direct effect of wealth. The first specification (Model 1 in Table 7) controls only for wealth. We find the wealth parameters to be positive and highly significant in each of the insurance coverage and risky investments equations. The null hypothesis $H_0 = \{\alpha_0 < 0, \beta_0 > 0\}$ in equation (4) is unambiguously rejected (P-value $< 0.01\%$). Thus, risky asset holding and car insurance coverage are both positively correlated with wealth. This result is inconsistent with standard theory under which portfolio and insurance decisions are modeled as an opposite risk retention tradeoff. In particular, it suggests that insurance is a normal good, in contrast with the seminal paper of Mossin (1968). Finally, note that ρ_{IR}, the correlation between the error terms ε_i^I and ε_i^R in equation (4), is positive and significant, thereby confirming that portfolio and insurance decisions are interdependent. As we shall see next, these results are robust as they still hold when we add controls.

Models 2: Characteristics of insurance contracts. Model 2 in Table 7 controls for factors that should enter a typical auto insurance contract. We find that, as expected, the level of insurance coverage increases with the value of the good insured and the measure of objective risk. Further, we find a positive correlation between the coverage selected and the premium paid. As can be seen in Table A5, where we estimate an auxiliary price model, this result reflects the fact that more comprehensive coverages command higher premia, consistent with intuition.[25] Finally, we find no evidence that respondents who live in densely populated zip codes purchase significantly more coverage. This does not imply that insurance

[25] Recall that the premium is not the price per unit of coverage. It is the total expense associated with a level of coverage (the unit price times the number of units of coverage). Hence, unlike standard demand functions where demand declines with price, the premium-coverage relationship should be positive. As is well known, however, this relationship can be difficult to identify precisely with choice data when prices and quantity are in equilibrium and all relevant variables are accounted for. This explains why the significance of the premium is lower in Models 4 and 5 of Table 7 when we control for the agent's and contract's characteristics.

companies do not use this variable to proxy for risks. Indeed, Table A5 shows that, all else equal, drivers in densely populated areas are charged significantly higher premia.

Model 3: Standard demographic characteristics. Model 3 in Table 7 controls for standard demographic characteristics. Observe first that the fit of the model improves substantially (as indicated by the AIC criterion). Further, the wealth parameters, while lower, remain positive and highly significant in the insurance and investment equations.

Model 3 also indicates that portfolio and insurance decisions vary with demographic characteristics. In particular, older households have significantly more car insurance coverage and a safer portfolio. The first result is new to the literature. The second result is consistent with Fagereng, Gottlieb and Guiso (2017), but it contrasts with early evidence from Ameriks and Zeldes (2004) who found no evidence of a reduction in portfolio shares with age.[26] Education also plays a prominent role. Respondents with higher education invest a larger share of their wealth in risky assets (consistent with Cole, Paulson and Shastry 2014), and they purchase more insurance coverage (consistent with Gropper and Kuhnen 2022).

Gender, marital status, and credit worthiness influence only portfolio decisions. Namely, households with a female respondent invest less in risky assets, while the portfolio of couples (married or not) and households with higher credit scores are more heavily skewed toward risky assets. As we shall see, the first result (about gender) is not robust as it ceases to hold when we add controls. Non-white respondents report having less insurance coverage and fewer risky assets. The effect however is only significant for Latinos, and it no longer holds once we control for subjective beliefs and credit worthiness.[27] Finally, we fail to identify a significant effect of employment status and family composition.[28]

[26] The negative correlation between risky asset holding and age is robust to alternative specifications in our data. Note, however, that adding a quadratic term in age reveals a statistically significant hump shape, but it does not improve the fit of the model substantially.

[27] The absence of a race effect in our regressions appears to be driven by these two variables. In particular, the parameters associated with *Black* and *Latino* are negative and significant in Models 3, 4 and 5 of Table 7 when we do not control for credit worthiness and subjective beliefs.

[28] To avoid a multicollinearity problem with wealth, we did not add a control for the household's income.

Model 4: Behavioral factors and frictions. We now add controls for subjective risks, financial literacy, knowledge and liquidity constraints. These behavioral factors and frictions have strong explanatory power. In particular, we find clear evidence that expectations matter: respondents who expect to incur more damages purchase more insurance coverage, and respondents who are more optimistic about the stock market invest more aggressively. The first result is new, while the second is consistent with Dominitz and Manski (2007) and Malmendier and Nagel (2011). Note that the measure of objective auto risks is positive and significant in Models 2 and 3, but it becomes insignificant in Model 4 when we control for subjective risks. Thus, consistent with intuition, we find that the amount of auto insurance purchased is driven more by the agent's subjective risks perception than by the objective risks he faces.[29] This result is new and it supports the views of Barseghyan et al. (2018) who suggest controlling for subjective beliefs to better understand insurance decisions.

Information also plays a significant role. Respondents who report having better knowledge of their car insurance policy have more coverage, and those with better knowledge of their debts and savings invest more in risky assets.[30] Similarly, Guiso and Jappelli (2005), and Gargano and Rossi (2018) find that information and knowledge are positively related to investment performance.

Respondents who report being more liquidity constrained have less insurance and fewer risky assets. Thus, we find evidence consistent with the common concern that the lack of sufficient insurance coverage is driven in part by binding budget constraints (e.g. Kunreuther and Pauly 2006).[31] Our results also suggest that all else equal, and in particular after

[29] This does not imply that respondents have biased beliefs or do not act rationally. It may be that drivers have additional information in which case the subjective risk measure may be a better proxy for the risks respondents actually face than the objective risk measure based on the past damages.

[30] We make no claim about causality and acknowledge that one may be better informed because one has more insurance coverage or because one owns risky assets.

[31] We estimated a model with the following interactions: "financial liquidity" * "high financial literacy," and "financial liquidity" * "credit score." The interaction terms were insignificant, while the sign and significance of the other parameters remained unchanged. Hence, it appears that liquidity constraints have a singular effect, and do not operate indirectly only through respondents with low financial literacy or respondents who made bad financial choices in the past. We also estimated a model with a variable measuring the respondent's expected credit conditions in the year ahead. The associated parameter was found to be insignificant while the liquidity constraint's parameter remained little changed. Hence, it seems that current, not expected,

controlling for education, respondents with lower financial literacy purchase less insurance and invest more conservatively. Similarly, Fang, Keane and Silverman (2008) find that elderly people with lower cognitive abilities are less likely to purchase Medigap insurance, while several studies (e.g. Lusardi, Michaud and Mitchell 2017 or Bianchi 2018) find that stock market participation is positively related with financial literacy. Finally, note that the wealth parameters remain highly significant. Hence, wealth appears to have a singular effect on insurance and portfolio decisions not captured by characteristics typically associated with wealth, such as age, education, liquidity constraints, or financial literacy.[32]

The finding that portfolio and insurance decisions have common frictions is new to the household finance literature and it has policy implications. In particular, regulators may be able to help households better manage insurance and investment choices through financial education or information. For instance, the experiment of Bhargava, Loewenstein and Sydnor (2017) suggests that improved insurance literacy can lead to better coverage decisions.

Model 5: Risk and time preferences. Model 5 of Table 7 controls for the respondent's risk and time preferences. Before we discuss the results, we make two comments.

First, under expected utility, wealth affects decisions only through the Arrow-Pratt coefficient of absolute risk aversion $A(.)$. Thus, if our measure of risk attitude is a sufficient statistic for $A(.)$, then theory predicts that the wealth parameters should become insignificant in Model 5. Note also that Figure 5, where we plot the average risk tolerance measure for each decile of wealth, shows a monotonic relationship consistent with DARA. This finding is consistent with many experimental and empirical studies (e.g. Guiso and Sodini 2013), and it provides support for the standard portfolio and insurance theories which assume DARA.

Second, the canonical portfolio and insurance models are atemporal. In particular, insurance is viewed as a transfer of wealth across states of the world, not time. As a result, time

liquidity conditions matter for portfolio and insurance decisions.

[32] All of these variables are highly but imperfectly correlated with wealth. For instance, the correlation between wealth and financial liquidity is 0.22. This reflects the well documented fact that some households although wealthy can be cash strapped (see e.g. Lusardi, Mitchell and Oggero 2018).

preferences should have no impact on the two decisions. The temporal dimension of risky investment decisions, however, is fairly natural. Further, it is increasingly recognized that insurance contracts, under which a premium is paid upfront against a contingent promise of future payments, have a time dimension as well (Casaburi and Willis, 2018, Ericson and Sydnor 2018, Rampini and Viswanathan 2022, Baillon et al. 2022). In that case, the demand for risky assets and for insurance could depend on both risk and time preferences.

Turning to the results of Model 5 in Table 7, we can see that our measure of risk attitude has a sensible and highly significant effect: respondents who report being more willing to take risks have less insurance coverage and riskier portfolios. Contrary to our prediction, however, the wealth parameters remain positive and highly significant in both the investment and insurance equations. Hence, it appears that wealth does not act purely as a risk preference shifter. Indeed, the wealthy are more risk seeking (as can be seen in Figure 5 and in their portfolio choices), yet they tend to purchase more insurance. This is a puzzle.

The results in the last column of Table 7 also indicate that time preferences affect both decisions: Patient respondents have riskier portfolios and purchase more insurance coverage. The first result is consistent with (e.g.) Epper et al. (2020) or Calvet et al. (2021). The second result is consistent with Bradford et al. (2018) who find that patient individuals are more likely to have health insurance. It also confirms that, contrary to standard theory, time preferences can shape portfolio and insurance decisions.[33]

We conclude this section with a short discussion of fit. To appreciate how well the model fits the data, we plot in Figure 6 the actual (black line) and predicted (red line) values of the risky financial share (left panel) and insurance index (right panel) for each decile of wealth (the other explanatory variables are taken at the median). Overall, the predicted values track the data well, suggesting that our baseline model provides a reasonable fit to the data.

[33] Table A6 shows that the results presented in this section remain virtually unchanged when we control for the year in which the data were collected. Table A7 shows that the puzzle is not driven by a specific segment of the wealth population and that the effect of wealth on portfolio and insurance decisions is monotonic. We also estimated more flexible functional forms with non-linear terms for other key covariates such as liquidity constraints, age, financial literacy or risk attitude. The nature of the results remained unchanged.

6 Robustness Checks

We test in this section the robustness of the results obtained with the baseline specification in Model 5 of Table 7.

Alternative measures of insurance coverage, wealth and risky assets. We start with alternative measures of insurance coverage. The dependent variable for the insurance equation in Models 1, 2 and 3 of Table A8 are $I_{i,2}$ (the relative index based on the empirical distribution of coverage), $I_{i,3}$ (the first principal component of the insurance coverage vector) and $I_{i,4}$ (the subjective measure in the 2016 and 2021 surveys), respectively. Models 4 and 5 control for differences in legal insurance requirements across states, while Model 6 excludes nonessential insurance add-ons that may be bought predominantly by the wealthy.

The baseline model was estimated using a respondent's financial wealth and the share of risky financial assets. In contrast, Model 1 in Table A9 uses net wealth and the share of total risky assets, Model 2 has financial wealth and the amount invested in risky financial assets, Model 3 uses net wealth and the amount invested in total risky assets, and Model 4 is the baseline model estimated without respondents with negative wealth.

As shown in Tables A8 and A9, virtually all the results discussed in the previous section still hold under these alternative specifications. Notably, the wealth parameters remain positive and highly significant in every specification, even after controlling for legal requirements, nonessential insurance add-ons and discarding respondents with negative wealth.

Wealth endogeneity: IV models. We now address the concern that wealth may be endogenous. In Table A10, the effect of wealth is identified using two standard instruments. The first measures changes in local house prices (as in Hurst and Lusardi 2004); the second measures unanticipated changes in wealth (as in Guiso and Paiella 2008). More specifically, Model 1 reports on the estimation of the baseline model in which wealth has been instrumented by the median house price growth in the respondent's zip code over the previous three years. In the survey, respondents are asked to evaluate how much their wealth has changed over the past 12 months and how much of the change was unexpected. In Model 2, wealth is instrumented by this unexpected percent change in wealth. Finally, the two instruments are combined in Model 3.

Table A10 shows that the F-statistics in the first stage regressions are relatively large, and certainly larger than the rule-of-thumb of 10 suggested by Staiger and Stock (1997). Thus, our instruments have explanatory power and we see no evidence of weak instruments. Next, observe that the wealth parameters remain positive and highly significant in every regression. This result is confirmed when using alternative instruments.[34] Thus, we find no evidence that the insurance-portfolio puzzle is due to the possible endogeneity of wealth.

Home insurance. We now test whether our results are confined to auto insurance or whether they extend to other forms of property insurance. To do so, we consider the home-owner/renter insurance questions in our survey. As explained in appendix C.1, respondents were asked about nine components of coverage for their primary home which are summarized in an index similar to $I_{i,1}$. In addition, respondents reported their home replacement cost, premium, objective and subjective risks (the value of all damages incurred over the past 2 years and expected over the next 2 years), and knowledge of their policy.

We report in Table A11 the estimates of the model with home insurance. Model 1 includes homeowners only, while Model 2 combines homeowners and renters. Qualitatively the results are remarkably similar for auto and home insurance. In particular, the two insurance decisions share most of the same determinants and frictions. Further, the wealth parameters are also positive and significant in Table A11. Thus, the insurance-portfolio puzzle is not confined to auto insurance and applies equally to home insurance.

Administrative data from France. We also tested the puzzle with data from a French bank (*Credit Agricole*) that offers both car insurance and traditional banking services. This robustness test is interesting for two reasons. First, it relies on administrative data rather

[34] Those include a measure of the respondent's income growth (as in Brunnermeier and Nagel 2008), changes in credit score, expected housing equity gains, and expected changes in credit availability. These instruments did not perform as well in the first stage, but the second stage conclusions remained unchanged.

than survey data.[35] Second, there are major institutional differences between the French and U.S. insurance systems. Most notably, there is no limit on liability coverage in France.[36]

The sample consists of 24,642 individuals with a bank account and a car insurance policy at *Credit Agricole*. As explained in appendix C.2, we define the variables as closely as possible to the baseline model. The individual characteristics, however, are limited to gender, age, employment status, local population density and credit worthiness.

The results in Table A12 indicate that portfolio and insurance decisions are driven by similar determinants in France and in the U.S. (e.g. risk, credit worthiness). However, there are some differences between the two countries. In particular, men and older people appear to invest more aggressively in France. These differences likely reflect the facts that i) the regression in Table A12 lacks controls (e.g. for education or liquidity constraints) and ii) the retirement systems differ substantially across the two countries. Note also that the parameters associated with wealth are all positive and significant in Table A12. Thus, we find that the insurance-portfolio puzzle is not confined to the U.S. and is also present in a country where liability coverage is not bounded.

Experimental evidence. In the 2021 survey we conducted an experiment in which respondents were asked to imagine they won a prize consisting of $500 in cash and a new car with a resale value of $20,000. Respondents faced two hypothetical risks, a high probability low consequence risk (20% chance of $500 in damages) and a low probability high consequence risk (1% chance of $15,000 in damages). For each risk, we elicited the respondent willingness to pay for an insurance that would cover the damages.

In principle, this exercise offers two key advantages. First, every respondent faces the same insurance decision (e.g. the value of the good insured, the risk, the insurance contract, search costs, liquidity constraints are the same for everyone). Second, the good insured is

[35] Administrative and survey data each have advantages and drawbacks. While administrative data are less likely to suffer from measurement errors, survey data are often more representative and more comprehensive (e.g. providing detailed information about wealth composition, demographics and behavioral characteristics).
[36] See e.g. www.index-assurance.fr/pratique/devis-souscription/garanties/la-responsabilite-civile.

fully exogenous and thus unrelated to the respondent's wealth and unobserved individual characteristics. These potential advantages explain why similar experiments have long been conducted to study insurance (e.g. Loewenstein et al. 2013, Bhargava et al. 2017, Brown et al. 2021) and portfolio decisions (e.g. Lian et al. 2019, Christelis et al. 2022).

The results in the first two columns of Table A13 indicate that actual and hypothetical insurance decisions are driven by most of the same determinants and frictions (e.g. education, financial literacy, risk attitude). Further, the insurance-portfolio puzzle is confirmed experimentally, although the positive effect of wealth on respondents' willingness to pay for insurance is significantly weaker for the high probability low consequence risk.

Within-person analysis. In 2022, we contacted 500 participants from the 2015 and 2016 waves and asked them to complete the survey again. For the 472 respondents who did so we can measure how changes in explanatory variables, and in particular changes in wealth, affected insurance coverage and portfolio holding. The advantage of this approach is that it removes any effects from unobserved individual characteristics.

The results reported in Table A14 confirm the insurance-portfolio puzzle. In particular, the estimates suggest that all else equal, a one standard deviation increase in wealth corresponds to a 0.43 standard deviation increase in the share invested in risky assets and a 0.37 standard deviation increase in the index of car insurance coverage. As a comparison, a one standard deviation increase in risk tolerance raises the share of risky investments and insurance coverage by 0.39 and 0.34 standard deviations, respectively. Hence, the impact of a wealth shock on the demand for risky assets and insurance is slightly larger than the impact a commensurate risk tolerance shock.

The results in Table A14 also confirm some of the determinants previously identified (e.g. subjective risk, financial liquidity, risk attitude), but others do not have a significant effect, presumably because they vary little over time (e.g. patience, financial literacy).[37]

[37] Some covariates were not included in the panel regression (e.g. age, gender, education) because they (essentially) did not change over time and across respondents.

Interestingly, the panel analysis reveals that labor shocks have an impact on household risk management: all else equal, becoming unemployed leads to a significant reduction in insurance coverage and risky assets holding. This background risk, however, does no capture the positive effect of wealth on insurance and portfolio decisions which remains highly significant.

7 Understanding the Puzzle

We have just established that the insurance-portfolio puzzle is statistically significant and robust. In this section, we first document that it is not due to behavioral mistakes. Then, we show that the puzzle no longer holds when we account for regret avoidance and non-performance risk. That is, the correlation between wealth and insurance coverage becomes negative, while wealth and risky investments remain positively correlated. As documented in appendix D, we tested several alternative hypotheses (including wealth dependent losses, consumption commitments, supply side effects, prospect theory, mental accounting, skewness preferences, salience theory) which all failed to improve our understanding of the puzzle.

7.1 Investments and insurance mistakes?

We explore the extent to which people make investments and insurance mistakes in appendix E. Consistent with previous literature (e.g. Calvet, Campbell and Sodini 2009), we find the poor to be less likely to participate in the stock market, their portfolio is less diversified and their equity exposure is less consistent with an optimal life-cycle asset allocation. We also find evidence that under-insurance is prevalent (e.g. roughly half of homeowners have low liability coverage), but no consistent pattern emerges by wealth. In contrast, over-insurance (e.g. having liability coverage in excess of one's assets) is more common among the wealthy. Thus, it would appear that the poor tend to under-invest in risky assets, whereas the rich tend to over-insure.[38] The latter is a new and surprising result as the wealthy are usually believed to adhere more closely to optimal behavior when making financial decisions.

[38] As shown in appendix E, the cost of over-insurance (at least 12.8% of the premium paid for those in the top quartile of wealth) is non-negligible and consistent with the cost of other financial puzzles in the literature.

As indicated in Figure 7 respondents seem to be aware of these biases. In particular, respondents in the bottom quintile of wealth are more likely to assess their portfolio as being too safe (row 1). Conversely, wealthy respondents predominantly report having more than the right amount of auto and homeowner insurance (row 2). Interestingly, wealthier respondents also find buying a little too much insurance more acceptable (rows 3 and 4). Hence, the wealthy seem aware and willing to over-insure, in which case their behavior should not be characterized as mistakes.

7.2 Nonperformance risk

In practice, insurance contracts sometimes fail to perform as expected: the claim's circumstances (e.g. is the insured's responsibility engaged?) or applicability (e.g. is the loss due to an "act of god"?) may be contested,[39] indemnity payments may be delayed (e.g. when the claim is randomly audited as in Bourgeon and Picard 2014), or the insurer may become insolvent (as in Thompson 2010). Doherty and Schlesinger (1990) show that such "nonperformance risk" renders most of the standard insurance results invalid. In particular, insurance demand does not necessarily increase with risk aversion, and insurance can be a normal good under DARA, as we show in appendix F. Intuitively, this is due to the fact that purchasing more insurance coverage enhances the downside risk under which damages are experienced and the premium is lost.

To measure the perceived risk of insurance and investment nonperformance we ask respondents *"If I were to submit a claim to my insurance company, then I am confident it will be paid in full and in time*" and "*If I made a successful investment with a bank or a financial institution, then I am confident I will be paid in full and in time*," with responses ranging from 1 (totally disagree) to 7 (totally agree). We also ask respondents whether they think nonperformance risk is *manageable*, in the sense that investing higher amounts with a bank or purchasing more coverage from an insurance company reduce the risk of nonperformance.

[39] For instance, insurers during the COVID-19 pandemic were reluctant to pay out claims for business interruption insurance.

As shown in Figure 7 (rows 5 and 6), we find no evidence that nonperformance risk is perceived to be prevalent or manageable for investments. In contrast, most respondents do not trust their insurance contract to perform and they think the risk of nonperformance can be managed (rows 7 and 8).[40] There are also marked differences by wealth: the poor report higher risks of insurance nonperformance, while the rich are more likely to agree that more insurance coverage reduces the risk of nonperformance.[41] These results are consistent with recent empirical analyses showing that the (perceived) risk of insurance nonperformance is prevalent.[42] In particular, Gennaioli et al. (2022) find that in (e.g.) Germany 16% of the claims submitted are rejected and eventual indemnifications average only 63% of initial claims. Similarly, Dunn et al. (2021) report that insurers deny (at least partially) 25% of Medicaid claims, while Briggs and Tonetti (2022) find that consumers expect to receive only a fraction of the promised payout for annuity, life and long-term care insurance.

7.3 Regret avoidance

Regret is a negative emotion experienced after realizing that a different decision would have led to a better outcome. Although regret is experienced ex-post, it has been shown to affect decisions ex-ante. In particular, evidence from neuroscience suggests that risky choices are influenced by anticipated regret (Camille et al. 2004, Coricelli et al. 2005, Frydman and Camerer 2016).[43] Regret theory (Bell 1982, Loomes and Sugden 1982, 1987, Diecidue and Somasundaram 2017, Gollier 2020) formalizes this intuition by incorporating regret

[40] To confirm these results, we asked 1,254 respondents in a subsequent survey to consider the following situation: "*You own a car and it is insured. You suffer $9,000 in damages on the car which you believe should be covered under your insurance contract.*" We then asked respondents to evaluate the chances of being indemnified in full and in time under two scenarios (presented in random order): when the coverage is $10,000 (scenario 1) or $20,000 (scenario 2). The average response was 38% under scenario 1 and 63% under scenario 2, a difference significant at the 1% level. This provides further evidence that insurance is strongly viewed as nonperformant and that nonperformance risk is perceived to decrease with insurance coverage.

[41] The first result may reflect the fact that because the rich have more insurance coverage, they perceive their own insurance contract as being more likely to perform.

[42] Schlesinger (2013) emphasizes that *perceived* nonperformance is sufficient to affect behavior.

[43] Even Harry Markowitz acknowledged that regret avoidance affected his portfolio decisions: "*I should have computed the historical co-variance of the asset classes and drawn an efficient frontier. Instead, I visualized my grief if the stock market went way up and I wasn't in it – or if it went way down and I was completely in it. My intention was to minimize my future regret. So I split my contributions 50/50 between bonds and equities*" (as quoted in Qin 2015).

avoidance into the utility function.[44] Regret avoidance has long been used to explain puzzles in various fields including finance and insurance.[45] In particular, Fujii, Okura and Osaki (2021) find that insurance can be a normal good when agents are regret-sensitive. Namely, they show that risk and regret have opposite effects when wealth increases: risk lowers the demand for insurance, whereas regret leads to higher coverage. Hence, insurance demand can increase with wealth when the regret effect dominates.

To measure the role of regret avoidance we asked respondents to think about the resources they devote to insurance and investments. For insurance (respectively, investments), the variable "Under-Commitment Regret" measures the anticipated regret from being under-insured when damages occur (respectively, having under-invested in a successful risky venture), while "Over-Commitment Regret" measures the anticipated regret from having bought insurance when no damages occur (respectively, having invested in an unsuccessful venture).[46]

Figure 7 suggests that regret avoidance is a strong driver of behavior. In particular, respondents consider under-commitment regret when they invest and especially when they insure (rows 9 and 11). In contrast, over-commitment regret seems to be a factor mostly for the portfolio choices of the average respondent (rows 10 and 12). There are also clear patterns by wealth: anticipated under-commitment regret (respectively, over-commitment regret) monotonically increases (respectively, decreases) for each wealth quintile in Figure 7.

7.4 Accounting for regret avoidance and nonperformance risk

We report in Table 8 the estimation of the benchmark model augmented with the measures of regret avoidance and nonperformance risk we just discussed. The results from Model 1 indicate that regret avoidance shapes portfolio and insurance decisions. In particular,

[44] As discussed in appendix D, regret theory is closely related to salience theory (Herweg and Mueller 2021, Lanzani 2022), skewness preferences (Gollier 2020) and narrow framing (Barberis, Huang, and Thaler 2006).
[45] Early applications of regret theory in finance include Shefrin and Statman (1984, 1985); for recent applications see e.g. Qin (2015, 2020), Börsch-Supan et al. (2018), Baule, Korn and Kuntz (2019), or Fioretti, Vostroknutov and Coricelli (2022). Applications of regret theory to insurance include Braun and Muermann (2004), Huang, Muermann and Tzeng (2016), Kunreuther and Pauly (2018) or Robinson et al. (2021).
[46] These measures are similar to Robinson et al. (2021), and akin to Qin (2015) who distinguishes regret over inaction from regret over action.

respondents who anticipate they will feel regret if they are insufficiently insured tend to purchase more coverage, while those who would regret being over-insured buy less coverage. These results are consistent with Robinson et al. (2021) who find that anticipating regret about being uninsured leads to flood insurance purchases. Table 8 also indicates that the fear of missing out on a profitable opportunity drives respondents to take more portfolio risks. This result is consistent with Muermann, Mitchell and Volkman (2006) and Qin (2020).

Model 2 in Table 8 shows that nonperformance risk lowers the demand for insurance. This result is consistent with laboratory experiments (e.g. Harrison and Ng 2019) and it supports Schlesinger (2013) and Gennaioli et al. (2022) who argue that nonperformance risk, although largely ignored in the insurance literature, is ubiquitous and consequential in practice. We also find that those who believe that nonperformance risk is manageable (i.e. having more coverage reduces the risk of nonperformance) tend to buy more insurance. This result is new to the literature and we show in appendix F that it is consistent with theory.

In contrast, Model 2 provides only weak evidence that nonperformance risk adversely impacts the demand for risky assets.[47] The distinct effect of nonperformance risk on portfolio and insurance decisions may reflect differences in the nature of the financial contracts. In particular, while Guiso et al. (2008) recognize that investors must consider the subjective risk of being cheated when making portfolio decisions, Guiso (2021) argues both parties are exposed to the possibility of abuse in an insurance contract. For instance, the insured can submit false claims, while the insurance company can reject valid claims. This may give rise to complex strategic interactions. For instance, as suggested by our results, consumers could choose to over-insure to signal they are more honest or more likely to contest denied claims, in which case the insurance company may respond by reducing nonperformance risk. Alternatively, consumers could find it advantageous to diversify their insurance portfolio

[47] The evidence, however, is stronger for the wealthy. Among respondents in the top quintile of wealth, those without stocks and mutual funds rate the risk of investment nonperformance significantly higher than those with risky assets. This result is consistent with Guiso, Sapienza and Zingales (2008) who identify the absence of trust as a major determinant of stock market non-participation among the rich. The effect of trust is studied explicitly in appendix D.

across different insurers to reduce the risk of nonperformance.[48]

Turning now to the effect of wealth, we can see in Models 1 and 2 of Table 8 that, when considered separately, regret avoidance and nonperformance risk attenuate substantially the insurance-portfolio puzzle, but do not explain it fully. That is, the parameter associated with wealth decreases by about 40% in the insurance equation, while it remains little changed in the risky investment equation. However, when regret avoidance and nonperformance risk are considered jointly in Model 3, the correlation between wealth and insurance coverage becomes insignificant and even turns negative, consistent with theory. Hence, the combination of two factors, regret avoidance and nonperformance risk, can explain why we found insurance to be a normal good, in contrast with the standard result in the insurance literature. Note that while both factors are needed to explain the puzzle, they reflect in fact the same underlying concern with receiving insufficient insurance compensation when losses occur. Going forward, a finer characterization of this concern should help improve our understanding of insurance demand in a more parsimonious manner.

8 Conclusion

Portfolio and insurance decisions are central to households' risk management, and thus to overall financial stability, as argued by Bhamra and Uppal (2019) or Gomes et al. (2021). Further, the two decisions should be interrelated because they reflect an opposite risk retention tradeoff. Using a unique sample of micro-level data with detailed demographic and behavioral characteristics, we conducted the first analysis of households' joint decision to insure and invest in risky assets. The analysis produced two sets of contrasting results.

First, consistent with the hypothesis that portfolio and insurance decisions are two sides of the same coin, we identify several joint determinants and frictions. In particular, risk attitude and subjective beliefs shape a household's investment and insurance behavior as predicted by theory. Further, we find that low education, liquidity constraints, impatience, information

[48] However, this strategy may be difficult to implement in practice because insurance contracts often specify that the same risk cannot be covered by different policies.

and financial literacy are all impediments to the demand for insurance and risky assets. Showing that the same determinants and frictions shape investment and insurance decisions is new to the household finance literature and it has policy implications. In particular, it implies that the policy interventions (e.g. financial education, regulation, innovation) suggested by Bhamra and Uppal (2019) could improve both decisions simultaneously.

Second, we identify a key difference between the two decisions in the form of an apparent puzzle: As a household's wealth grows, its risk taking increases for portfolio decisions but it decreases for insurance decisions. This insurance-portfolio puzzle is new to the literature, economically relevant and statistically robust. Further, we find that the essence of the puzzle is captured by a surprising behavioral asymmetry about the way households manage financial risks: the poor are more likely to under-invest, while the rich are more likely to over-insure. The latter challenges traditional thinking under which the poor are not sufficiently insured (Kunreuther and Pauly 2006) and the rich are less prone to financial mistakes (Calvet et al. 2009). Interestingly, evidence suggests that over-insurance by the wealthy reflects deliberate choices, not behavioral mistakes. After testing several hypotheses, we find that the insurance-portfolio puzzle can be explained by the combination of two factors, regret avoidance and nonperformance risk. That is, when we control simultaneously for these factors, the correlation between wealth and risky asset holding remains positive, while the correlation between wealth and insurance coverage becomes negative, as predicted by theory.

These results provide support to Bleichrodt and Wakker (2015) and Diecidue and Somasundaram (2017) who argue that regret theory is a powerful alternative to expected utility to explain puzzles in economics and finance. They also complement Gennaioli et al. (2022) who conclude that nonperformance risk is a fundamental feature of property insurance markets. More generally, our results support the views of Guiso (2012, 2021) who argues that portfolio and insurance contracts differ in a fundamental way. Whereas portfolio decisions involve one-sided trust (investors part with their money trusting it will be returned as promised), insurance contracts involve two-sided trust (e.g. consumers can make invalid claims and firms can deny or delay valid claims). The latter can give rise to complex and not well understood strategic interactions. Consistent with Gomes et al. (2021), we believe that more research is needed to understand how households combine different financial decisions to manage their risk exposure. Our study suggests that achieving this objective will require to understand better not only how individuals make risky choices in different contexts, but also how contractual differences across financial markets can affect behavior.

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Table 1: Demographic Characteristics (N=3,194)			
	Mean	Median	Std
Age	49.54	49.00	15.63
Female	0.49	0.00	0.50
Married	0.65	1.00	0.48
Have children	0.38	0.00	0.49
Education	1.97	2.00	0.74
Risk tolerance	3.63	4.00	1.65
Patience	6.90	7.00	2.27
Financial liquidity	0.78	0.99	0.32
Low financial literacy	0.27	0.00	0.44
Zip density (in 1,000)	3.62	1.50	7.89
Credit score	3.89	4.00	1.35

Education: 1 = Less than BA, 2 = BA, 3 = More than BA (e.g. Master, Doctorate, Professional degree).
Risk tolerance = Measure (from Dohmen et al. 2011) of willingness to take risk regarding financial matters between 1 (not willing at all) and 7 (very willing).
Patience = Measure (from Falk et al. 2022) of willingness to give up something today in order to benefit in the future between 1 (not willing at all) and 10 (very willing).
Financial liquidity = Reported percent chance to come up with $2k if the need arose.
Low financial literacy = 1 when respondent gets fewer than 4 out of 6 financial literacy questions correct.
Zip density = Population density in the respondent's zip code (in 1,000).
Credit score: 1 =< 620, 2 = between 620 and 679, 3 = between 680 and 719, 4 = between 720 and 760, 5 => 760.

Table 2: Components of Financial Wealth (N=3,194)			
	Mean	Median	Std
Retirement savings†	246.12	100.00	389.21
Savings & investments†	103.35	20.00	302.56
Other Assets†	79.89	25.00	175.81
Non-housing debt†	44.05	20.00	79.17
Financial wealth†	315.07	102.55	595.67
Share of risky financial assets	0.34	0.29	0.25

† In $1,000.
Retirement savings = Money on IRA, 401K, thrift, savings plan.
Savings and investments = Money on checking and savings accounts, CDs, stocks, bonds, mutual funds, Treasury bonds.
Other assets = Jewelry, valuable collection(s), vehicles, cash value in a life insurance policy, rights in a trust or estate.
Non-housing debt = Balances on credit cards, auto loans, student loans, personal loans, medical or legal bills.
Share of risky financial assets = Proportion of financial assets owned in stocks and mutual funds.
Except for the next to last row (Financial wealth), all statistics are conditional on the variable being strictly greater than 0.

Table 3: Components of Net Wealth (N=3,194)			
	Mean	Median	Std
Primary home value†	287.64	225.00	242.90
Home equity†	204.43	135.00	231.40
Housing debt†	157.63	125.00	129.05
Business equity†	155.25	90.00	244.62
Net wealth†	469.48	225.05	727.82
Share of total risky assets	0.62	0.65	0.24

† In $1,000.
Primary home value = Self-reported value of primary home (if it were sold today).
Home equity = Value of all homes minus all outstanding loans against the home(s).
Housing debt = Outstanding mortgages for all homes.
Net wealth = Financial wealth + home and business equity.
Share of total risky assets = proportion of total assets owned in stocks, mutual funds, homes and business.

Table 4: Auto Insurance			
	Mean	Median	Std
Car value†	15.67	13.00	13.55
Damage past 2 years (in $)	1,438.6	0.0	6,031.3
Damage expected next 2 years	1,889.2	750.0	2,844.9
Annual premium (in $)	1,047.2	950.0	592.9
Liability component	1.62	2.00	0.54
Injury component	1.43	2.00	0.70
Collision component	2.34	3.00	1.25
Comprehensive component	2.37	3.00	1.39
Uninsured component	1.94	2.00	1.41
Rental component	0.55	1.00	0.50
Towing component	0.59	1.00	0.49
Simple index $I_{i,1}$	4.32	4.75	1.72
Relative index (CDF) $I_{i,2}$	0.17	0.05	0.24
First component $I_{i,3}$	0.01	0.35	1.74
Self-reported measure $I_{i,4}$	5.33	6.00	1.35

† In $1,000.
Liability: 0=No coverage, 1=Legal minimum, 2=More than legal minimum.
Injury: 0=No coverage, 1=Legal minimum, 2=More than legal minimum.
Collision: 0=No coverage, 1=deductible>$1,000, 2=$501<deductible<$1,000, 3=$251<deductible <=$500, 4=deductible<=$250.
Comprehensive: 0=No coverage, 1=deductible>$1,000, 2=$501<deductible<$1,000, 3=$251<deductible <=$500, 4=deductible<$250.
Uninsured: 0=No coverage, 1= Coverage<$10k, 2=$10k<coverage<$50k, 3=$50k<coverage<$100k, 4=Coverage>$100k.
Rental: 0=No coverage, 1=coverage.
Towing: 0=No coverage, 1=coverage.

Table 5: Correlation between Auto Insurance Indexes			
	Simple index $I_{i,1}$	Relative index (CDF) $I_{i,2}$	First component $I_{i,3}$
Relative index (CDF) $I_{i,2}$	0.71	__	__
First component $I_{i,3}$	0.95	0.70	__
Self-reported measure $I_{i,4}$	0.59	0.39	0.60

Table 6: Correlation with Auto Insurance Premium										
$I_{i,1}$	$I_{i,2}$	$I_{i,3}$	$I_{i,4}$	Liability	Injury	Collision	Comprehensive	Uninsured	Rental	Towing
0.23	0.20	0.24	0.22	0.03	0.05	0.08	0.07	0.01	0.12	0.08

Table 7: Baseline Model

Wealth = Financial wealth, $I_{i,1}$ = Simple index of insurance coverage, R_i = Share of risky financial assets

	Model 1		Model 2		Model 3		Model 4		Model 5	
	$I_{i,1}$	R_i	$I_{i,1}$	R_i	$I_{i,1}$	R_i	$I_{i,1}$	R_i	$I_{i,1}$	R_i
Wealth	1.012*** (0.074)	0.416*** (0.019)	0.858*** (0.073)	0.417*** (0.019)	0.594*** (0.075)	0.366*** (0.019)	0.594*** (0.074)	0.325*** (0.018)	0.605*** (0.077)	0.291*** (0.018)
Insurance Premium	—	—	0.018** (0.008)	—	0.016** (0.008)	—	0.015* (0.008)	—	0.014* (0.008)	—
Car Value	—	—	0.022*** (0.003)	—	0.021*** (0.003)	—	0.017*** (0.003)	—	0.018*** (0.003)	—
Objective Risk Auto	—	—	0.105** (0.041)	—	0.083** (0.041)	—	0.035 (0.041)	—	0.034 (0.040)	—
Zip Density	—	—	1.258 (4.588)	—	1.846 (4.570)	-0.036 (0.810)	1.017 (4.414)	0.312 (0.837)	1.965 (4.428)	0.294 (0.831)
Age	—	—	—	—	0.012*** (0.002)	-0.003*** (0.001)	0.009*** (0.002)	-0.003*** (0.001)	0.008*** (0.002)	-0.002** (0.001)
Female	—	—	—	—	-0.062 (0.058)	-0.030** (0.014)	-0.020 (0.058)	-0.024* (0.014)	-0.034 (0.057)	-0.021 (0.014)
Married	—	—	—	—	0.040 (0.067)	0.079*** (0.017)	-0.021 (0.066)	0.059*** (0.016)	-0.020 (0.065)	0.053*** (0.016)
Have Kids	—	—	—	—	0.079 (0.065)	0.016 (0.016)	0.093 (0.063)	0.027* (0.016)	0.108* (0.063)	0.022 (0.016)
Black	—	—	—	—	-0.059 (0.114)	-0.022 (0.029)	-0.022 (0.110)	-0.012 (0.029)	-0.004 (0.108)	-0.013 (0.029)
Latino	—	—	—	—	-0.236** (0.113)	-0.052* (0.028)	-0.157 (0.112)	-0.035 (0.028)	-0.147 (0.111)	-0.037 (0.027)
Unemployed	—	—	—	—	-0.176 (0.171)	-0.065 (0.042)	-0.158 (0.171)	-0.052 (0.042)	-0.133 (0.172)	-0.061 (0.041)
High Education	—	—	—	—	0.266*** (0.069)	0.085*** (0.017)	0.183*** (0.067)	0.065*** (0.017)	0.185*** (0.067)	0.065*** (0.016)
Low Education	—	—	—	—	-0.324*** (0.072)	-0.106*** (0.018)	-0.243*** (0.072)	-0.075*** (0.018)	-0.257*** (0.072)	-0.071*** (0.018)
Credit Score	—	—	—	—	0.032 (0.025)	0.059*** (0.006)	0.023 (0.025)	0.038*** (0.007)	0.022 (0.025)	0.036*** (0.006)
Subjective Risk	—	—	—	—	—	—	0.139*** (0.035)	0.381*** (0.079)	0.136*** (0.035)	0.333*** (0.081)
Low Financial Literacy	—	—	—	—	—	—	-0.231*** (0.072)	-0.077*** (0.018)	-0.258*** (0.071)	-0.064*** (0.018)
Knowledge	—	—	—	—	—	—	0.178*** (0.021)	0.025*** (0.009)	0.177*** (0.021)	0.019** (0.009)
Financial Liquidity	—	—	—	—	—	—	0.379*** (0.105)	0.257*** (0.028)	0.435*** (0.104)	0.235*** (0.028)
Patience	—	—	—	—	—	—	—	—	0.041*** (0.014)	0.012*** (0.003)
Risk Tolerance	—	—	—	—	—	—	—	—	-0.090*** (0.019)	0.035*** (0.005)
Correlation (ρ_{IR})	0.136*** (0.021)		0.102*** (0.021)		0.075*** (0.021)		0.079*** (0.021)		0.087** (0.021)	
AIC	15,348.3		15,243.2		14,756.0		14,584.3		14,536.1	

N=3,194. Estimated constant term not reported. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

"Knowledge" is a measure of the respondent's knowledge of his car insurance policy in the insurance equation and of the respondent's knowledge of his debts and savings in the investment equation.

"Subjective risk" is the sum of all monetary damages the respondent expects to incur over the next two years in the insurance equation and the respondent's expected change in the U.S. stock market over the next 12 months in the investment equation.

Table 8: Baseline Model with Anticipated Regrets and Nonperformance Risk

Wealth = Financial wealth, $I_{i,1}$ = Simple index of insurance coverage, R_i = Share of risky financial assets

	Baseline Model		Model 1		Model 2		Model 3	
	$I_{i,1}$	R_i	$I_{i,1}$	R_i	$I_{i,1}$	R_i	$I_{i,1}$	R_i
Wealth	0.533*** (0.120)	0.268*** (0.030)	0.316** (0.130)	0.261*** (0.030)	0.325** (0.140)	0.260*** (0.031)	-0.022 (0.149)	0.254*** (0.030)
Insurance Premium	0.007 (0.011)	—	0.008 (0.011)	—	0.007 (0.010)	—	0.008 (0.010)	—
Car Value	0.021*** (0.004)	—	0.020*** (0.004)	—	0.022*** (0.004)	—	0.022*** (0.004)	—
Objective Risk Auto	0.002 (0.058)	—	-0.002 (0.057)	—	0.022 (0.057)	—	0.022 (0.057)	—
Age	0.007** (0.003)	-0.002** (0.001)	0.008** (0.003)	-0.002** (0.001)	0.008** (0.003)	-0.002** (0.001)	0.010*** (0.003)	-0.002** (0.001)
Female	-0.080 (0.090)	-0.038* (0.023)	-0.052 (0.089)	-0.038 (0.024)	-0.053 (0.090)	-0.033 (0.023)	-0.011 (0.090)	-0.033 (0.023)
Married	0.034 (0.101)	0.071*** (0.026)	0.065 (0.101)	0.070*** (0.026)	0.046 (0.100)	0.063** (0.027)	0.090 (0.101)	0.062** (0.026)
High Education	0.195* (0.104)	0.055** (0.026)	0.202* (0.106)	0.054** (0.026)	0.210** (0.105)	0.057** (0.026)	0.226** (0.103)	0.056** (0.026)
Low Education	-0.231** (0.109)	-0.071** (0.028)	-0.234** (0.109)	-0.072*** (0.027)	-0.243** (0.109)	-0.071** (0.028)	-0.254** (0.110)	-0.072*** (0.028)
Credit Score	0.037 (0.041)	0.044*** (0.012)	0.040 (0.041)	0.044*** (0.012)	0.030 (0.041)	0.042*** (0.012)	0.032 (0.040)	0.042*** (0.012)
Subjective Risk	0.137** (0.054)	0.336** (0.154)	0.127** (0.054)	0.333** (0.154)	0.153*** (0.053)	0.344** (0.153)	0.143** (0.053)	0.341** (0.153)
Low Financial Literacy	-0.238** (0.107)	-0.058** (0.027)	-0.236** (0.108)	-0.056** (0.027)	-0.248** (0.106)	-0.059** (0.027)	-0.248** (0.106)	-0.058** (0.027)
Knowledge	0.073** (0.032)	0.026* (0.014)	0.066** (0.032)	0.027* (0.014)	0.070** (0.032)	0.027* (0.014)	0.061* (0.032)	0.027* (0.014)
Financial Liquidity	0.363** (0.161)	0.272*** (0.047)	0.341** (0.159)	0.268*** (0.047)	0.382** (0.160)	0.265*** (0.047)	0.364** (0.157)	0.262*** (0.047)
Patience	0.047** (0.023)	0.015** (0.006)	0.051** (0.022)	0.015** (0.006)	0.051** (0.022)	0.015** (0.006)	0.057** (0.023)	0.015*** (0.006)
Risk Tolerance	-0.102*** (0.029)	0.030*** (0.008)	-0.091*** (0.02)	0.029*** (0.008)	-0.093*** (0.029)	0.029*** (0.008)	-0.075** (0.029)	0.028*** (0.008)
Under-Commitment Regret	—	—	0.080** (0.031)	0.011 (0.008)	—	—	0.104*** (0.033)	0.010 (0.007)
Over-Commitment Regret	—	—	-0.075** (0.034)	-0.017** (0.007)	—	—	-0.087** (0.034)	-0.016** (0.007)
Nonperformance Risk	—	—	—	—	-0.068** (0.028)	-0.017* (0.009)	-0.067** (0.028)	-0.016* (0.009)
Manageable Nonperformance Risk	—	—	—	—	0.124** (0.061)	0.011 (0.007)	0.177*** (0.065)	0.012 (0.007)
Additional Controls†	Yes		Yes		Yes		Yes	
Correlation (ρ_{IR})	0.087*** (0.021)		0.082*** (0.020)		0.075*** (0.021)		0.079*** (0.021)	
AIC	6,350.5		6,334.6		6329.7		6,311.5	

† Each model also includes the following variables "Zip Density," "Have Kids," "Black," "Latino," "Unemployed."

N=1,383. Estimated constant term not reported. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

"Knowledge" is a measure of the respondent's knowledge of his car insurance policy in the insurance equation and of the respondent's knowledge of his debts and savings in the investment equation.

"Subjective risk" is the sum of all monetary damages the respondent expects to incur over the next two years in the insurance equation and the respondent's expected change in the U.S. stock market over the next 12 months in the investment equation.

"Under-Commitment Risk" is the extent to which the respondent anticipates feeling regrets from under-investing (respectively under-insuring) if the investment is a success (if she incurs damages).

"Over-Commitment Risk" is the extent to which the respondent anticipates feeling regrets from over-investing (respectively over-insuring) if the investment is a failure (if she incurs no damages).

"Nonperformance risk" is the risk that the insurance company will not pay a claim in full and in time in the insurance equation and the risk that a bank or financial institution will not pay out in full and in time a successful investment in the investment equation.

"Manageable Noncompliance Risk" is the extent to which the respondent thinks buying more insurance coverage (respectively investing more with a financial institution) lowers the risk of insurance (respectively investment) nonperformance.

Figure 1: Distributions of Wealth and Share of Risky Assets

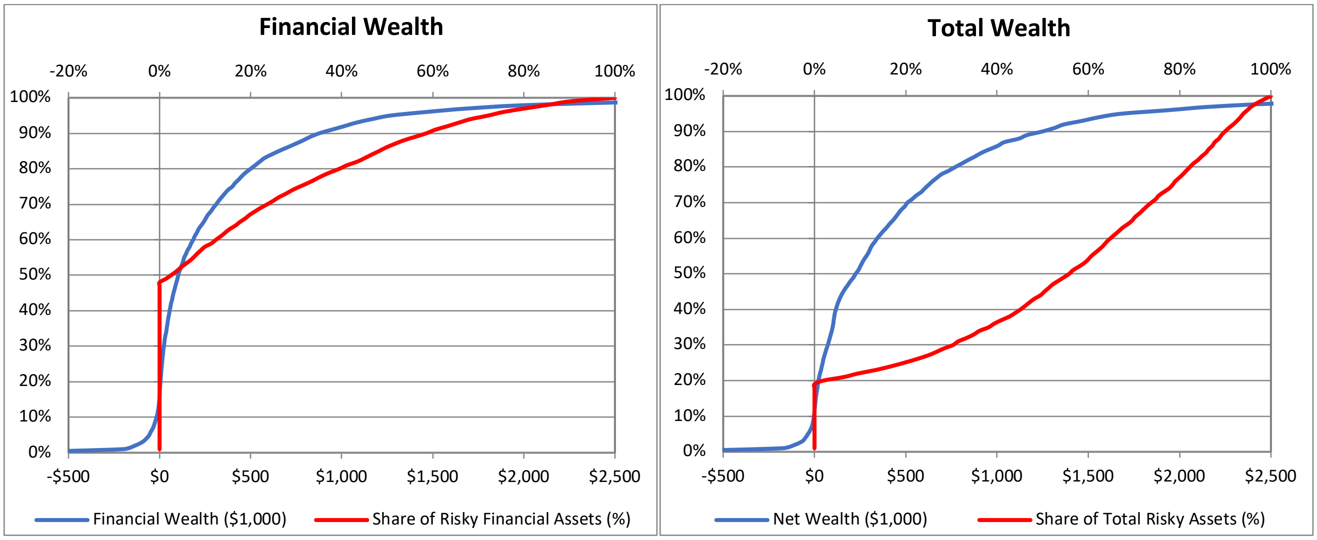
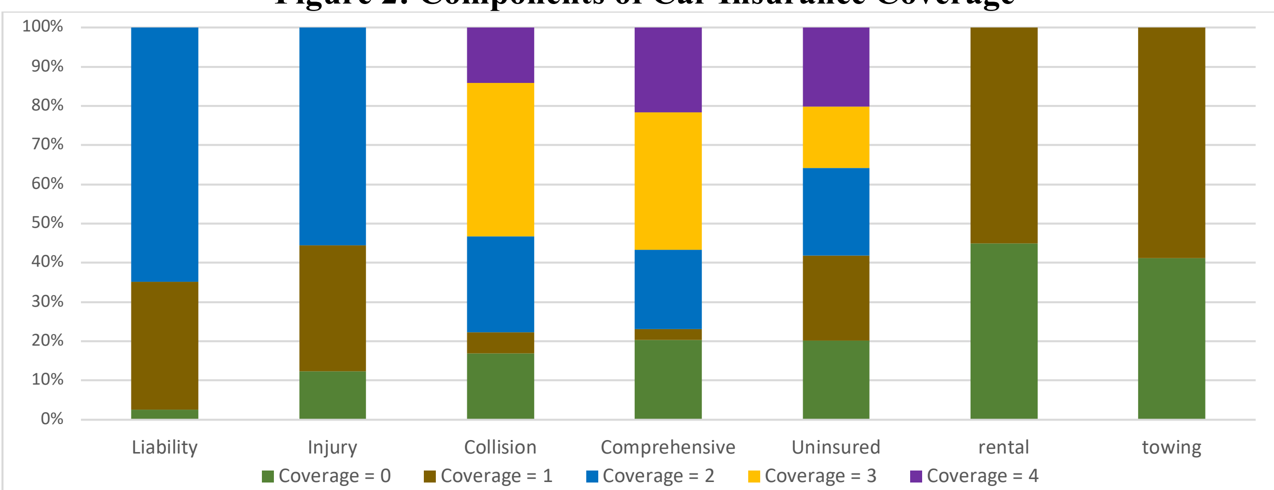
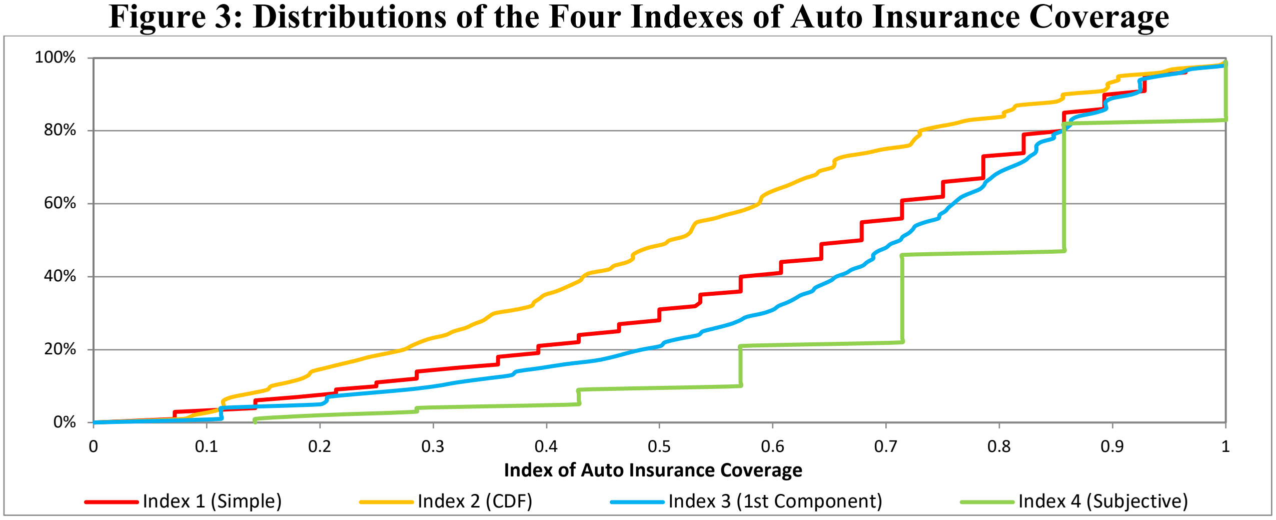


Figure 2: Components of Car Insurance Coverage



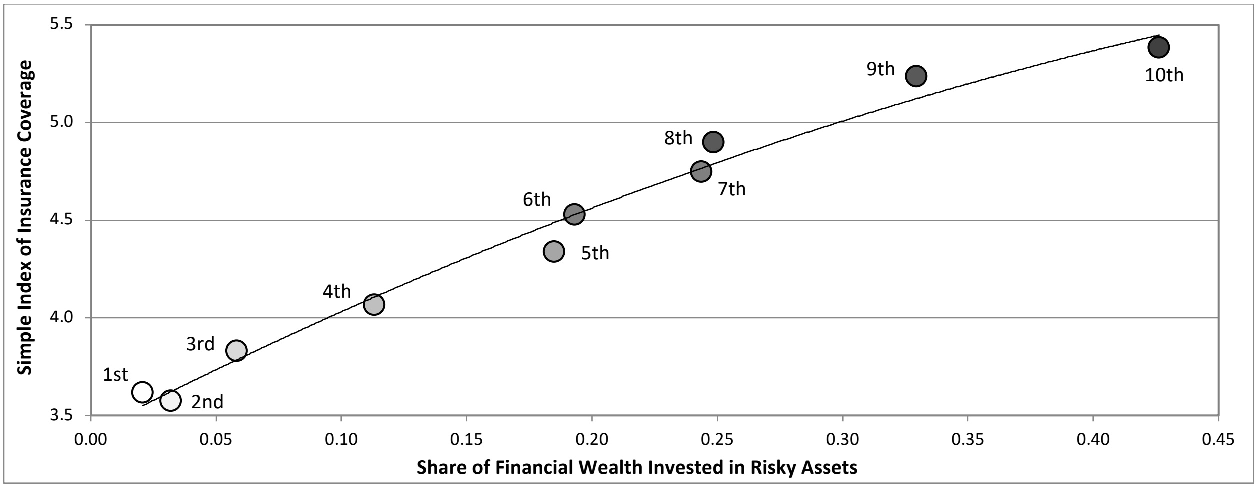
Liability: 0=No coverage, 1=Legal minimum, 2=More than legal minimum. **Injury**: 0=No coverage, 1=Legal minimum, 2=More than legal minimum. **Collision**: 0=No coverage, 1=deductible>$1,000, 2=$501<deductible<$1,000, 3=$251<deductible<=$500, 4=deductible<=$250. **Comprehensive**: 0=No coverage, 1=deductible>$1,000, 2=$501<deductible<$1,000, 3=$251<deductible<=$500, 4=deductible<$250. **Uninsured**: 0=No coverage, 1= Coverage<$10k, 2=$10k<coverage<$50k, 3=$50k<coverage<$100k, 4=Coverage>$100k. **Rental**: 0=No coverage, 1=Coverage. **Towing**: 0=No coverage, 1=Coverage.

Figure 3: Distributions of the Four Indexes of Auto Insurance Coverage



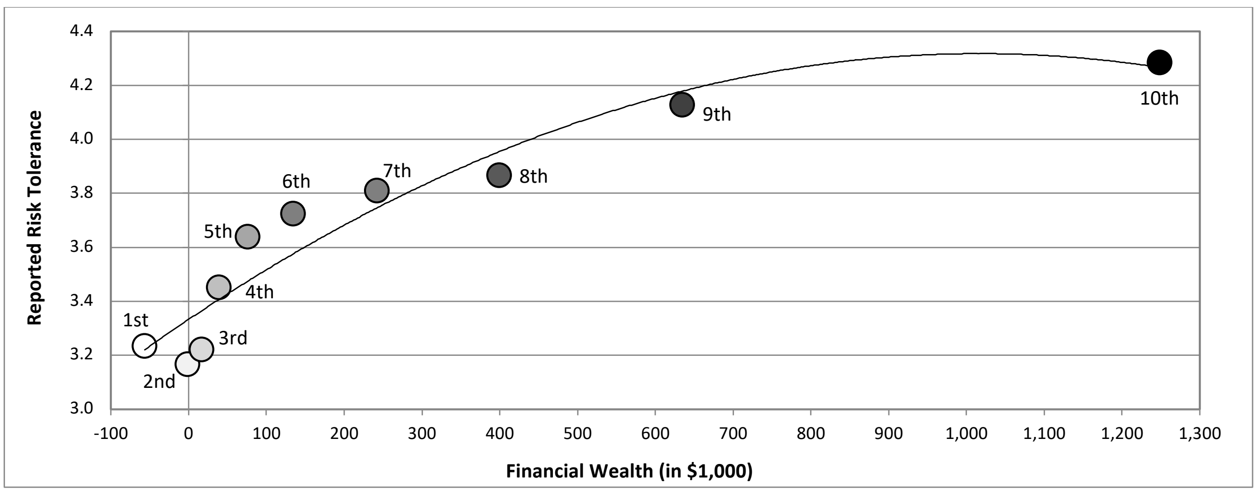
Each index has been normalized to 1 for comparison.

Figure 4: Insurance Coverage and Share of Risky Assets for Each Decile Wealth



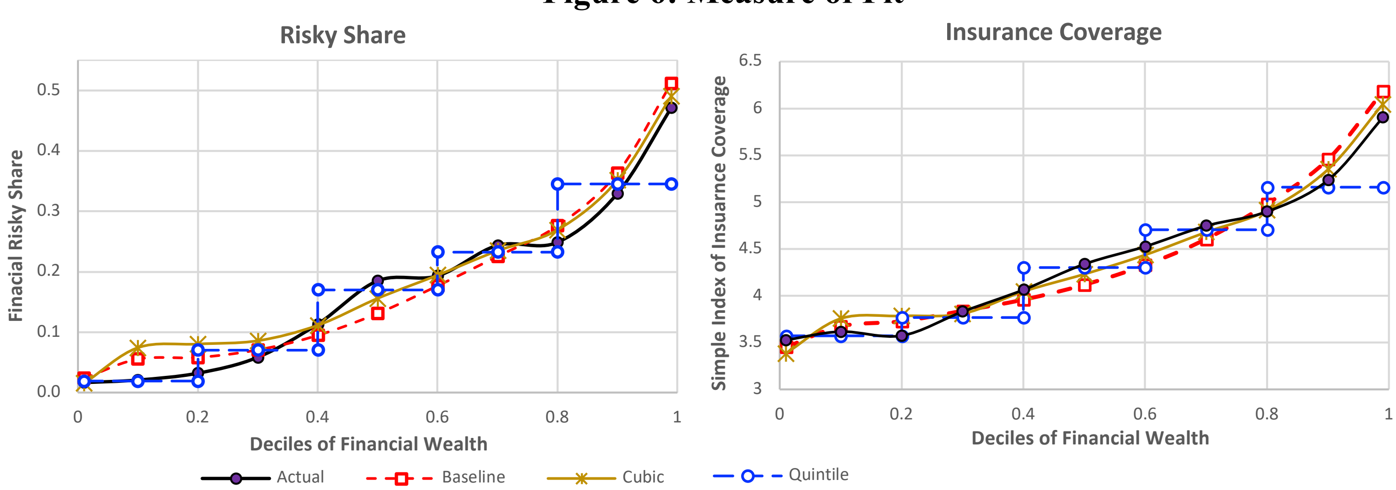
Each dot corresponds a decile of financial wealth.

Figure 5: Link between Wealth and Risk Tolerance by Decile of Wealth



Each dot corresponds a decile of financial wealth.

Figure 6: Measure of Fit



Actual: Average for respondents in each decile of wealth. **Baseline**, **Cubic**, **Quintile** correspond to predictions from the models in Table A7 at each decile of wealth (the other variables are taken at their medians).

Figure 7: Subjective Assessment of Portfolio and Insurance Choices